



Armed Forces College of Medicine AFCM



Viral Lower Respiratory tract infections (Part 1)

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INTENDED LEARNING OBJECTIVES (ILO)



By the end of this lecture the student will be able to:

1. Describe the structure and antigenicity of viruses causing LRTIs
2. Describe pathogenesis and clinical manifestations of viral LRTIs
3. Outline laboratory diagnosis of viral LRTIs.

Respiratory Tract Infections

Upper respiratory tract Diseases

Common Cold **Pharyngitis**

Otitis Media

Sinusitis

Laryngitis

Epiglottitis

Upper and Lower respiratory Tract Diseases

Croup

Influenza

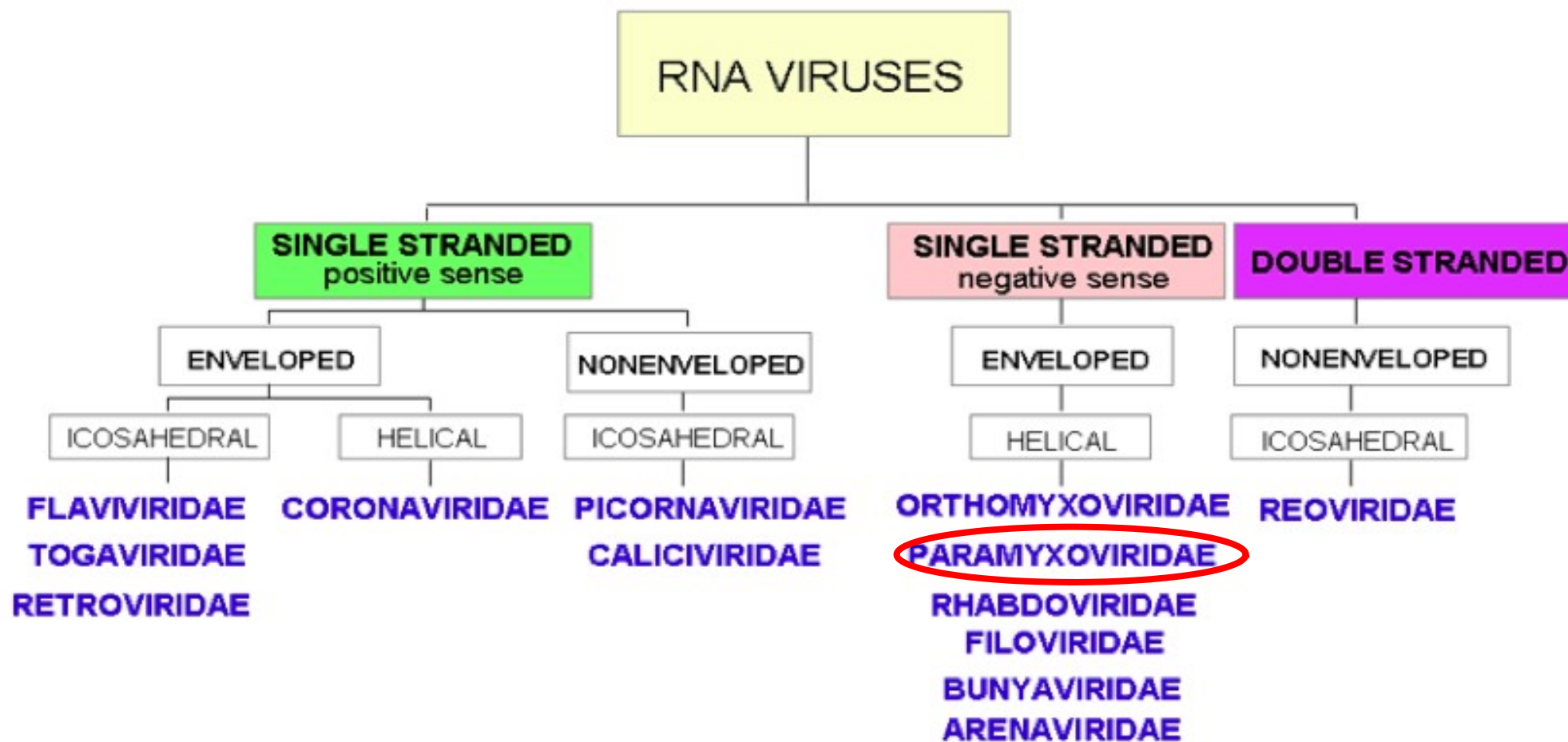
Whooping Cough

Lower Respiratory Tract Diseases

Bronchitis **Bronchiolitis** **Pneumonia**

Pulmonary TB

Lung Abscess



LARYNGITIS

2-Croup



Definition

Inflammation of vocal cords of the larynx

Etiology

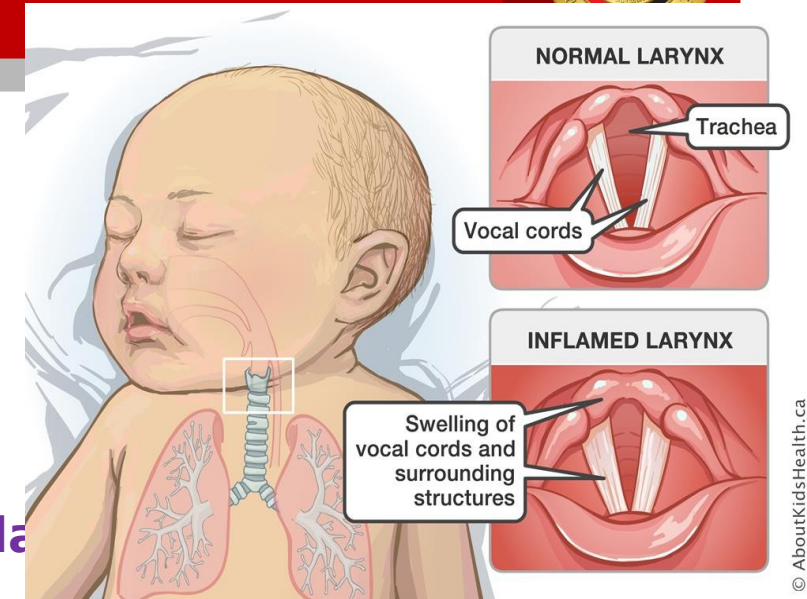
1- Parainfluenza virus & Rhinoviruses (commonest causes of laryngitis)

2-Influenza & corona viruses

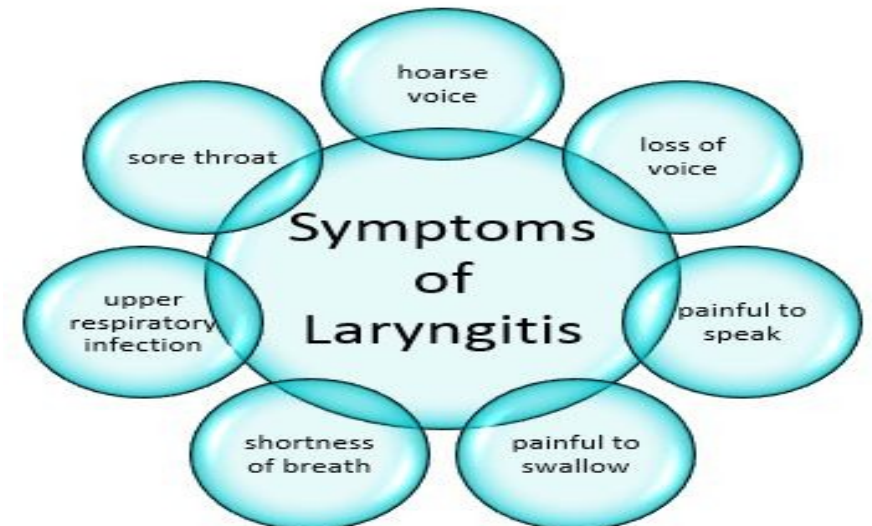
Clinical picture

■ Hoarseness of voice

■ Aphonia (inability to speak)



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CROUP



Definition

Inflammation of larynx ,trachea & large bronchi (larngotrach

Etiology

1- Parainfluenza virus (especially type 1): commonest ca

2- Respiratory syncitial virus (RSV)

Clinical manifestations

1-Inspiratory stridor (harsh noise on breathing due to c
especially in children

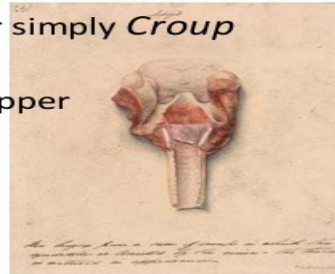
2-Hoarseness of voice

Croup

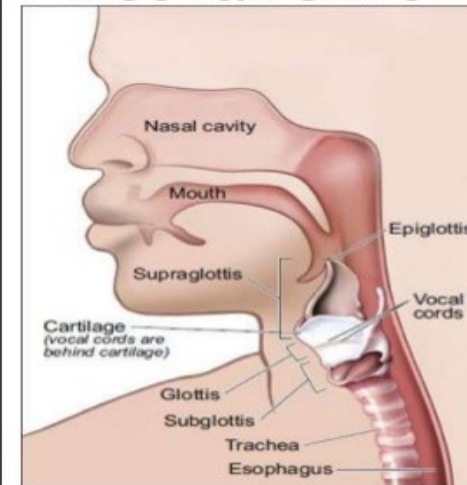
Derived from the old Anglo-Saxon verb croup meaning "to cry hoarsely".

Laryngotracheobronchitis or simply Croup

The most common form of acute upper respiratory obstruction.

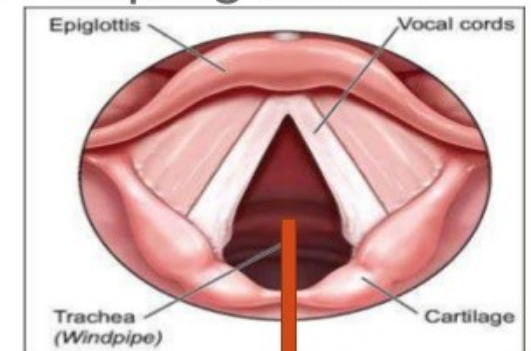


Mechanism of developing stridor



Stridor can occur at the following places:

1. **Nose & Mouth**
2. **Larynx** (Epiglottis, Supraglottis, Glottis, Subglottis)
3. **Trachea.**



•An infant or child's airway lumen is naturally narrower/smaller than adults.
•Therefore, any minor reductions to this airway diameter (such as inflammation, mucosal edema, foreign object, collapsing epiglottis) can result in further narrowing or obstruction of the airway.
•Due to this narrowing, it causes an exponential increase in airway resistance which makes it significantly difficult for the child to breathe.

Human parainfluenza viruses (HPIVs)



Structure

A - Family : paramyxoviruses

B-Nucleocapsid

■ **ss RNA**

• Helical

C- Enveloped with 2 surface glycoproteins

1-Bifunctional protein : Haemagglutinin-neuraminidase (H,

attaching the virus
to host-cell

receptors(early)

2-Fusion (F) protein (see RSV)

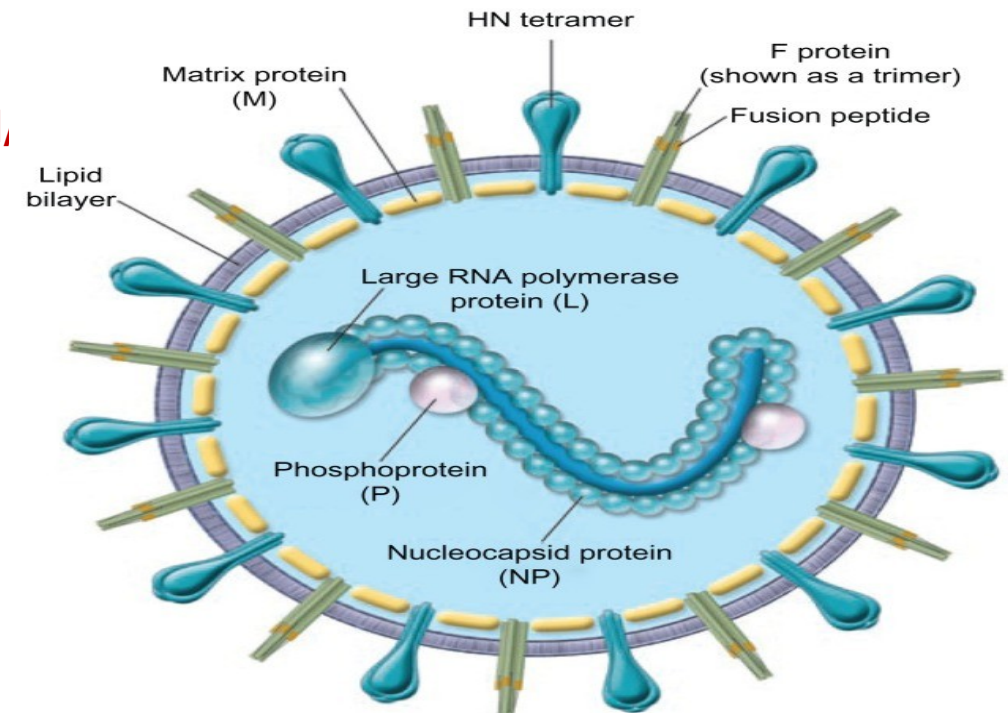
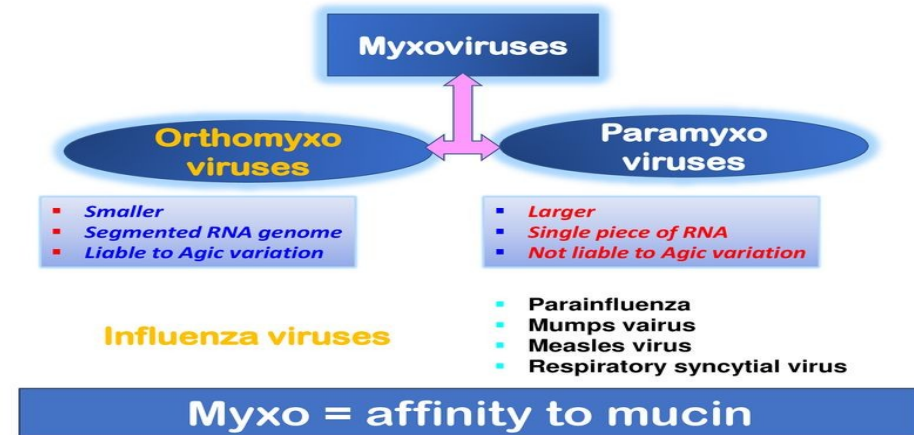
releasing new
virions from
infected cells(late).

C-Classification

4 serotypes : HPIV 1, 2, 3, 4

9/11/24

infectious module



Human parainfluenza viruses (HPIVs)



Pathogenesis & Clinical manifestations

A-The infection is localized to RT (no viremia).

in both adults & young children

The virus attaches to host cells by **haemagglutinin**



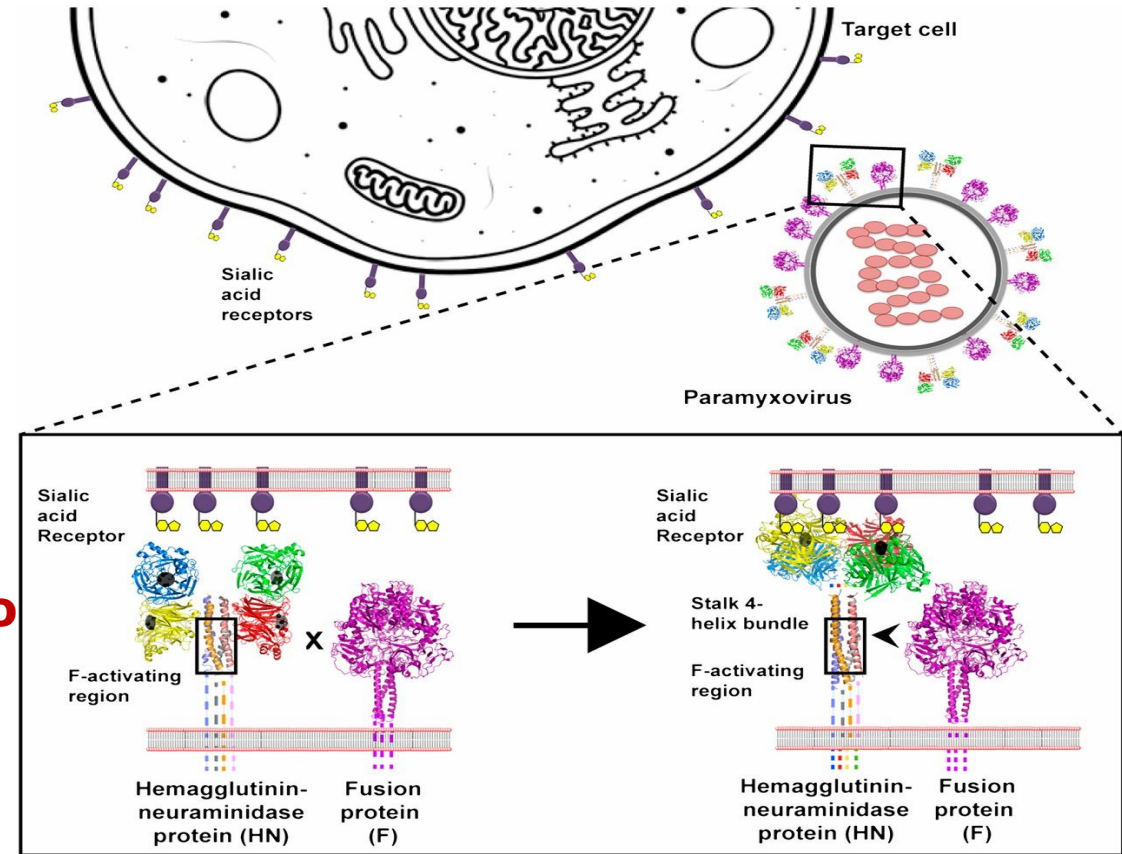
Envelope fuses with the host cell membrane by **F pro**

B-In adults

- Virus multiplication & Inflammation **are limited**

to **upper RT**

Disease : Common cold.



Human parainfluenza viruses (HPIVs)



C - In young children < 5 years

- Airways are small & immunity is immature



Bronchi, bronchioles and lungs are involved

- Vocal cords of the larynx become swollen



Obstruction to the inflow of air



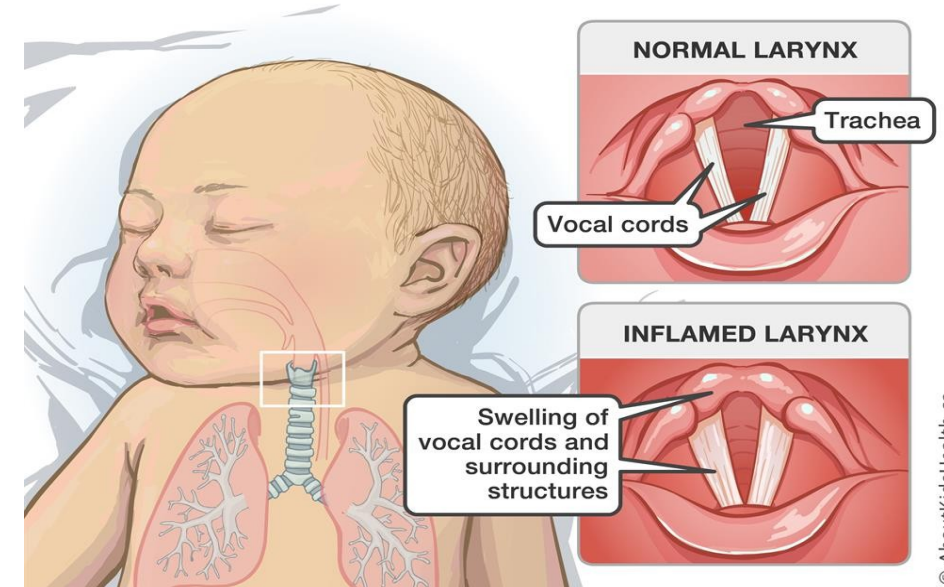
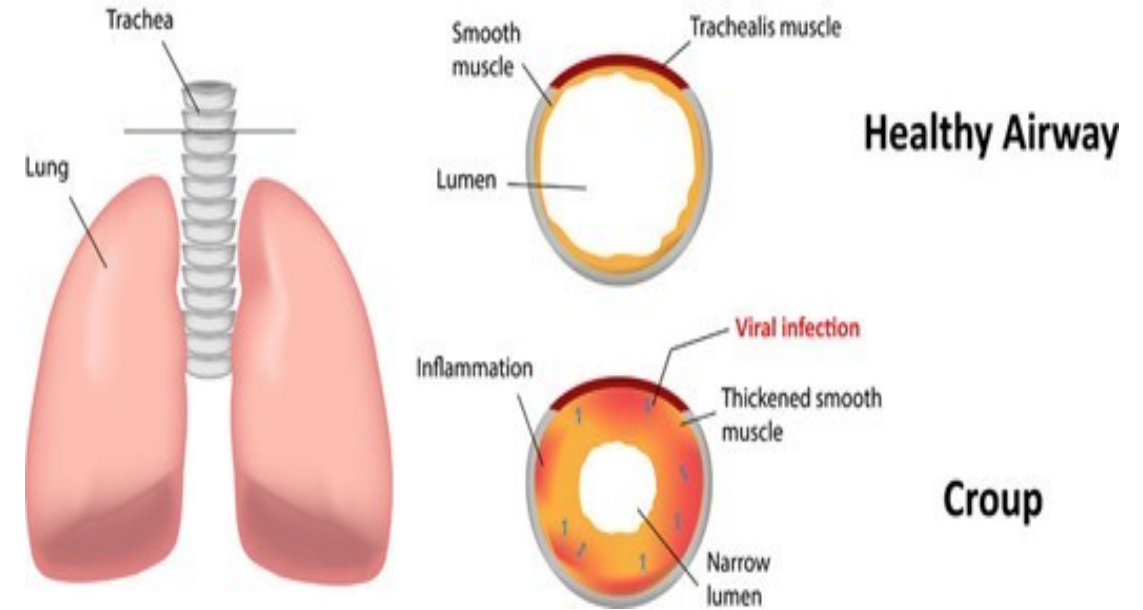
Inspiratory stridor

■ Diseases

1-Croup (acute laryngotracheobronchitis)

2-Laryngitis, bronchiolitis and pneumonia.

infectious module



Human parainfluenza viruses (HPIVs)



Laboratory diagnosis

Specimen: nasopharyngeal aspirate.

A-Direct demonstration

1-Detection of Ag : by DIF

2-Detection of viral RNA : by PCR

B-Serology :

Detection of **IgM** OR **rising titer of IgG**

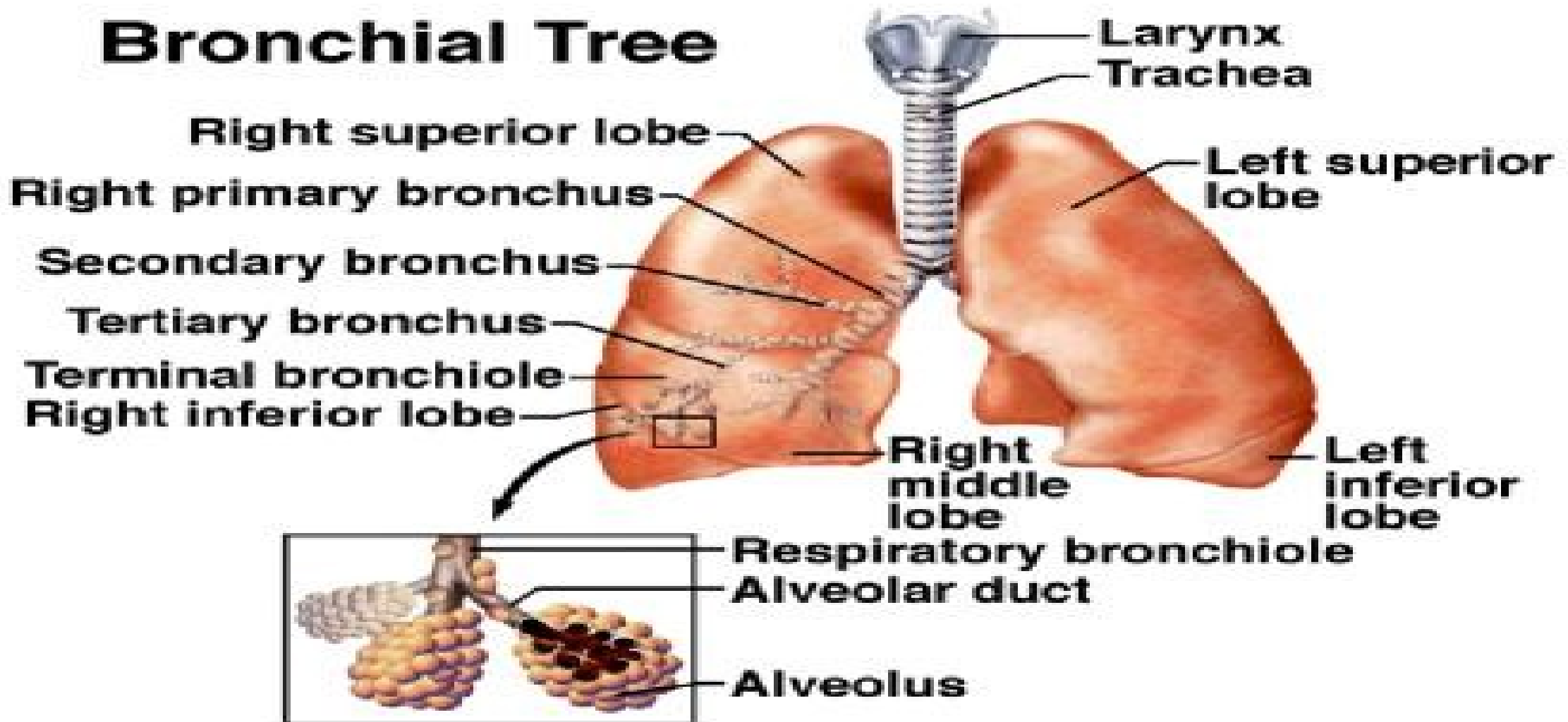
Parainfluenza Virus Laboratory Diagnosis

- Detection of Antigen - a rapid diagnosis can be made by the detection of parainfluenza antigen from nasopharyngeal aspirates and throat washings.
- Virus Isolation - virus may be readily isolated from nasopharyngeal aspirates and throat swabs.
- Serology - a retrospective diagnosis may be

Lower Respiratory Tract Infections



Bronchial Tree



Respiratory Tract Infections

Upper respiratory tract Diseases

Common Cold **Pharyngitis**

Otitis Media

Sinusitis

Laryngitis

Epiglottitis

Upper and Lower respiratory Tract Diseases

Croup

Influenza

Whooping Cough

Lower Respiratory Tract Diseases

Bronchitis **Bronchiolitis** **Pneumonia**

Pulmonary TB

Lung Abscess

1-BRONCHITIS



Definition

Self limited inflammation of bronchi

Etiology of acute bronchitis

Viruses : Most common 1ry pathogens

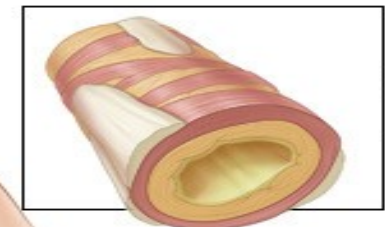
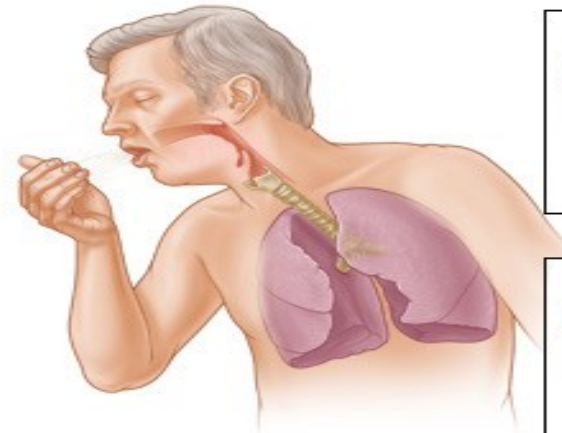
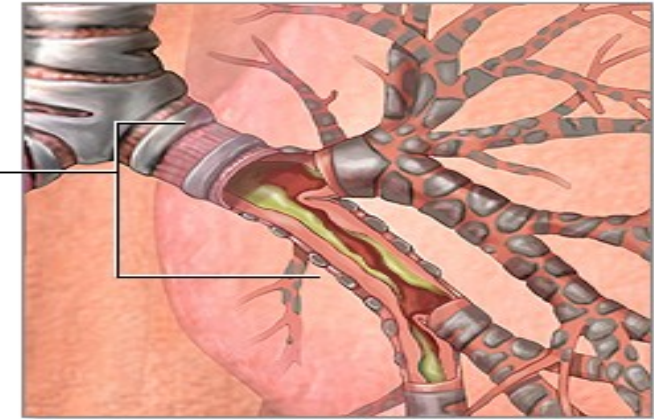
1-Influenza viruses

2-Parainfluenza viruses ,

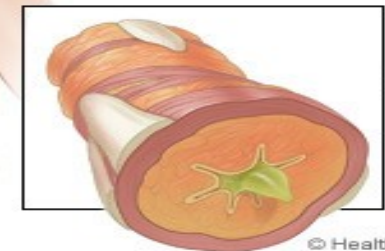
3-Respiratory syncytial virus



Inflamed
primary and
secondary
bronchi



Normal
bronchial
tube



Inflamed
bronchial
tube

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1- BRONCHITIS



Pathogenesis

⊛ Viral infection → inflammatory response

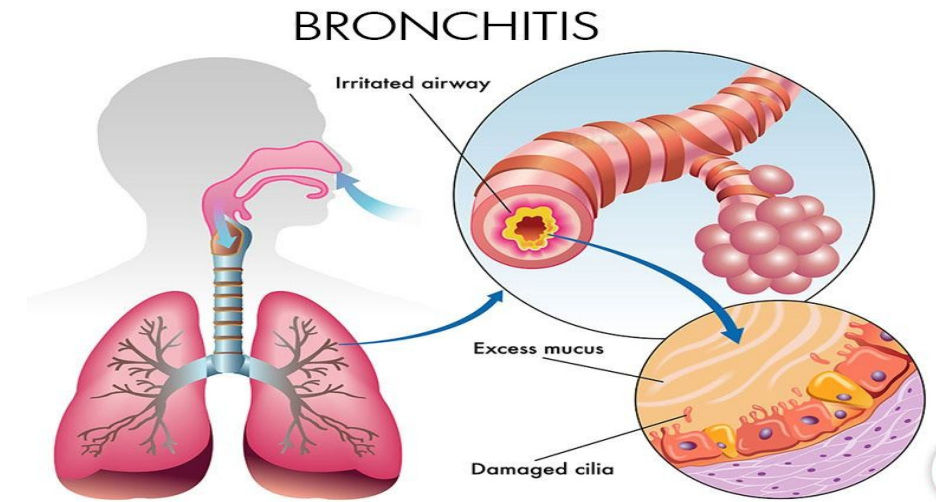
→ ↑ mucus production

→ **coughing** (to clear mucus).

⊛ Clinical Manifestations

1-URTIs symptoms : Nasal congestion, sore throat

2-Cough , with or without sputum



The Symptoms of **BRONCHITIS**



- Cough
- Production of mucus (sputum), which can be clear, white, yellowish-gray or green in color
- Fatigue
- Shortness of breath
- Slight fever and chills
- Chest discomfort

2-BRONCHIOLITIS



Definition

Inflammation of the bronchioles ;
the small airways **less than 2 mm in diameter**

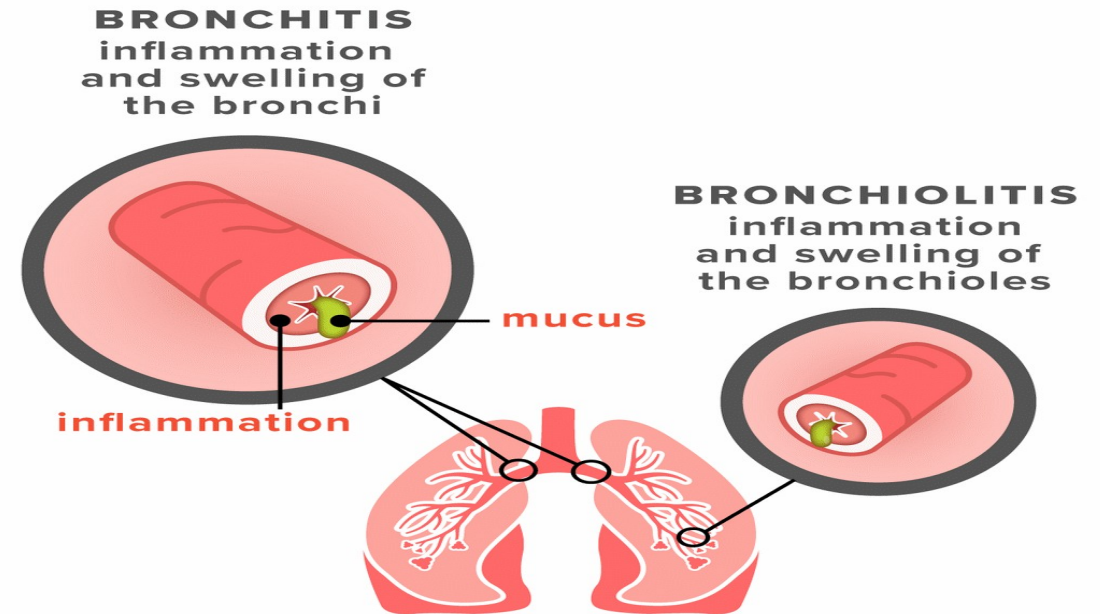
Etiology

Viruses are the only pathogens in child

1-Respiratory syncytial virus (main cause)

2-Human metapneumovirus (2nd common)

3- Parainfluenza virus



Bronchiolitis is caused by a viral infection and is seasonal ,peaking in the winter months.

The most common cause is respiratory syncytial virus (RSV) which accounts for 80% of cases

2-BRONCHIOLITIS



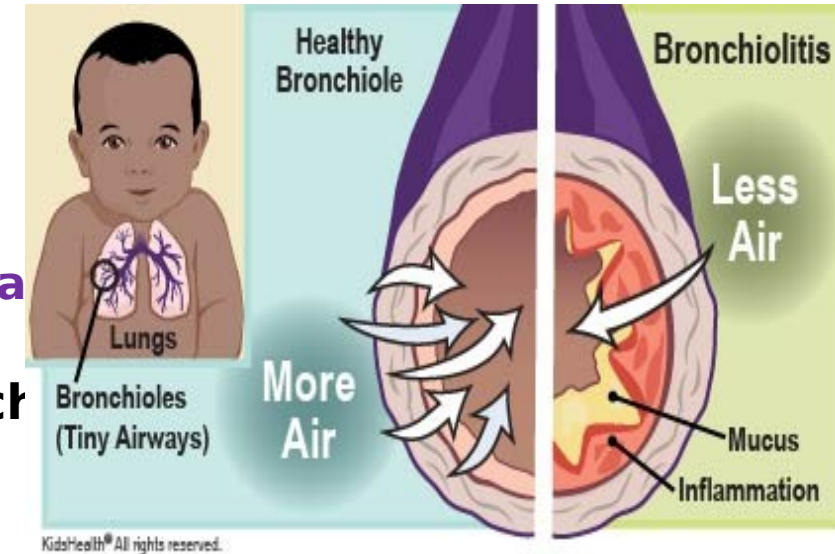
Pathogenesis

Age affected

Particularly among children under 2 years of age as bronchioles ha

Viruses **directly** damage the epithelial cells of the **terminal bronch**

Inflammation and obstruction of the **small airways**.

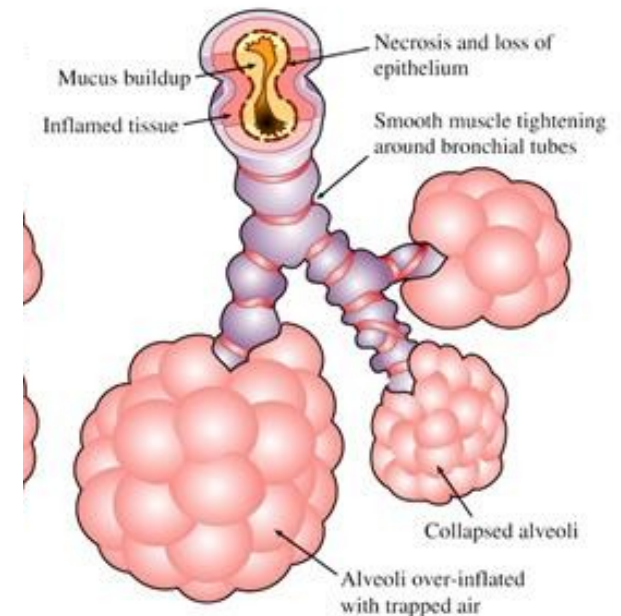


Clinical Manifestations

Respiratory distress

➤ **Cough, cyanosis**

➤ **Dyspnea**



Respiratory syncytial virus (RSV)



Structure

A - Family : paramyxoviruses

B-Nucleocapsid

■ **ss RNA**

• Helical

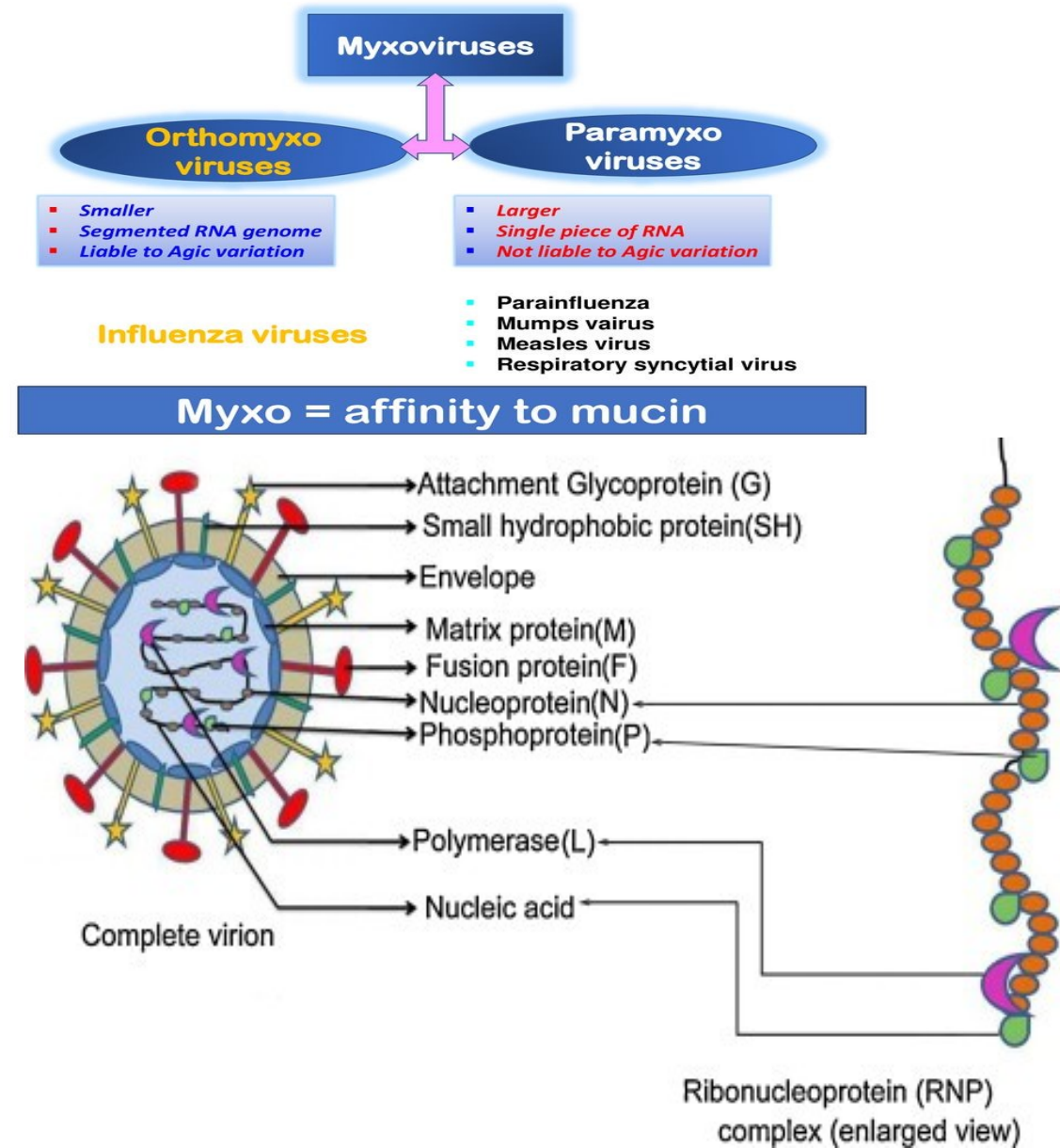
C- Enveloped ,with 2 surface glycoproteins (No H/N)

1-G protein



Attachment to host cells

2-Fusion (F) protein



Respiratory syncytial virus (RSV)



Pathogenesis

A-Mode of transmission

1-Droplet

2-Direct contact of contaminated hands with nose or mouth
RSV causes outbreaks of respiratory infections especially in young children

B-Viral replication

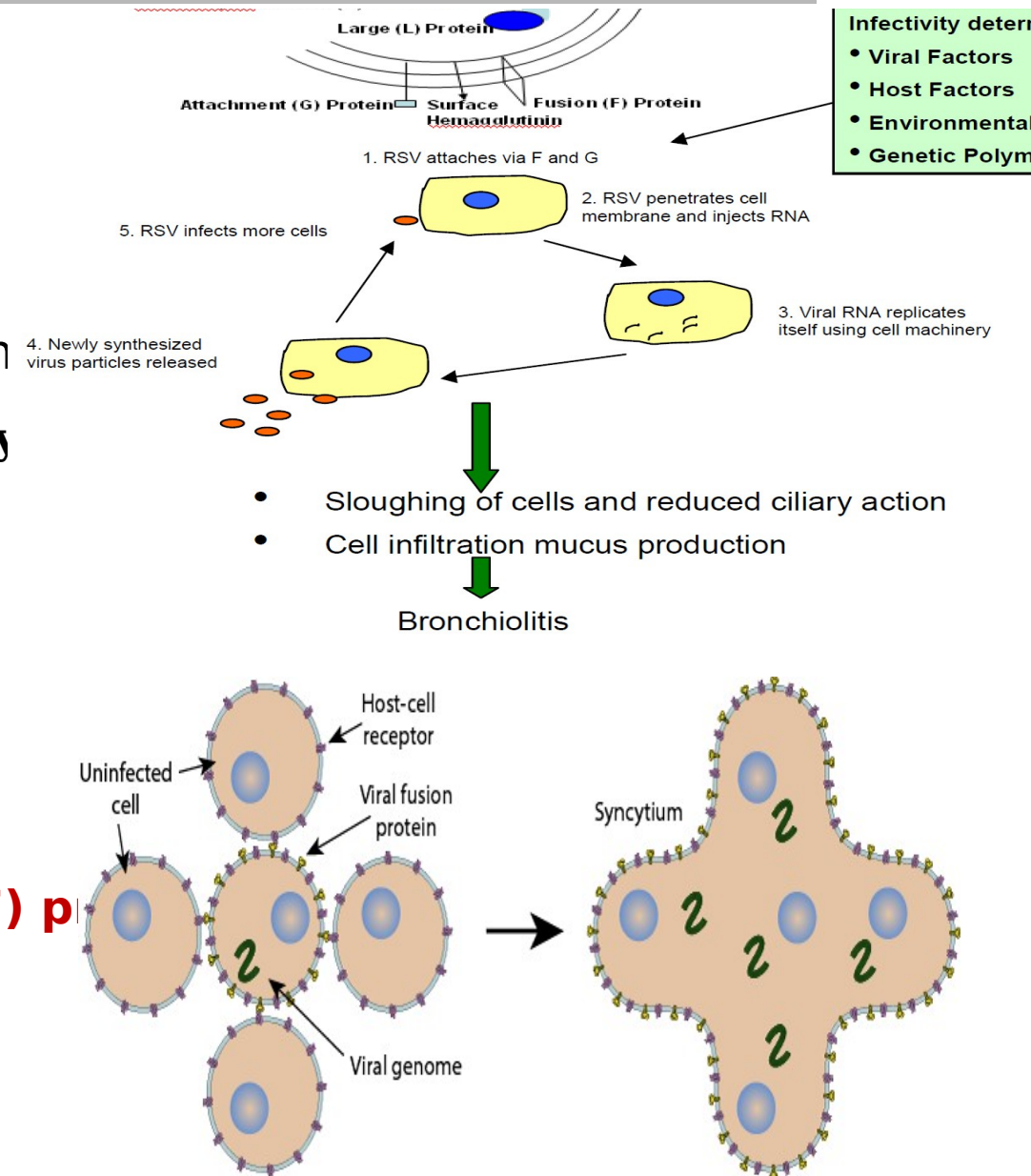
A-The infection is localized to RT (no viremia).

B-The virus attaches to host cells by G protein

Envelope fuses with the host cell membrane by **fusion (F) protein**

F protein causes cells to fuse

Formation of **multinucleated giant cells (syncytia)**



C-Immunity

1-Repeated infections are common,Why?

a-Incomplete (short lived) immunity :

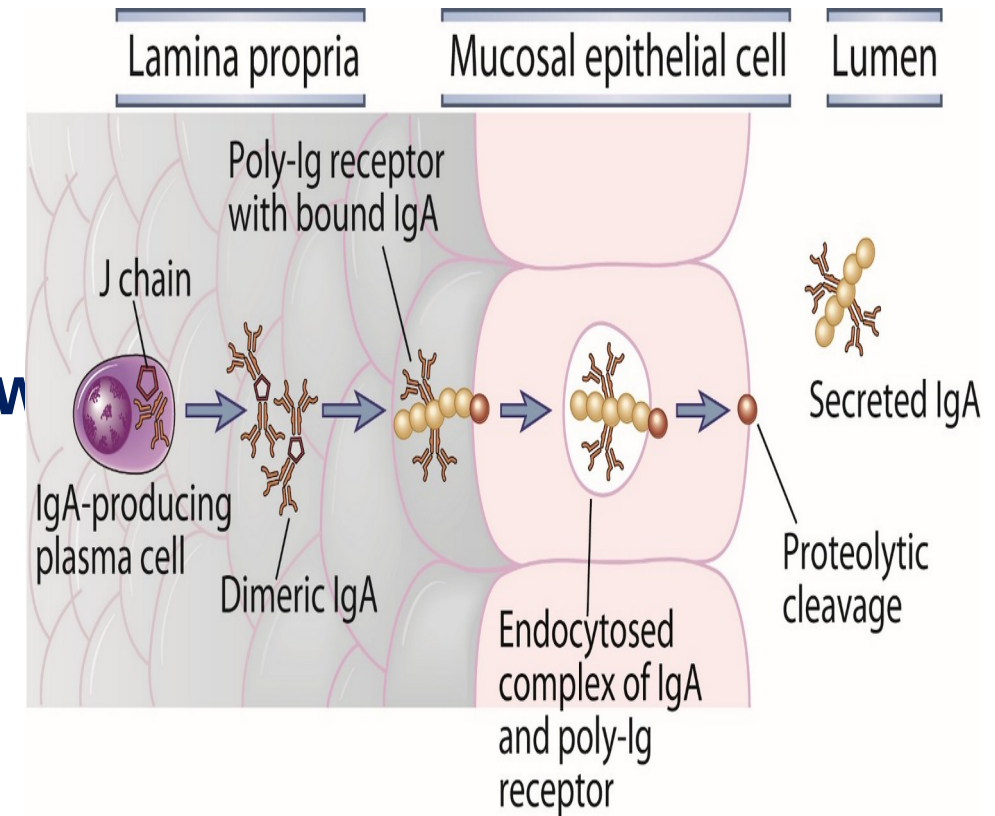
as it is mainly due to **IFN α & secretory IgA**

b -Antigenic drift : variation in surface proteins

2-Frequency & severity of infection ↓ with aging , W

a-↑ Secretory IgA

b- Larger air passages



Respiratory syncytial virus (RSV)



Clinical manifestations

A- Infants (< 2 yrs)

Bronchiolitis & pneumonia (commonest cause)

B- Adults

Common cold & bronchitis

C - Elderly, adults with heart or lung diseases & immunocompromised patients

Pneumonia.



Laboratory diagnosis

Specimen : nasopharyngeal aspirate

A-Direct virus demonstration :

a. Rapid Ag test : by **DIF** (commonly used)

b. Detection of viral nucleic acid : by **PCR**

B-Isolation

CPE : **syncytia** formation

C-Serology :

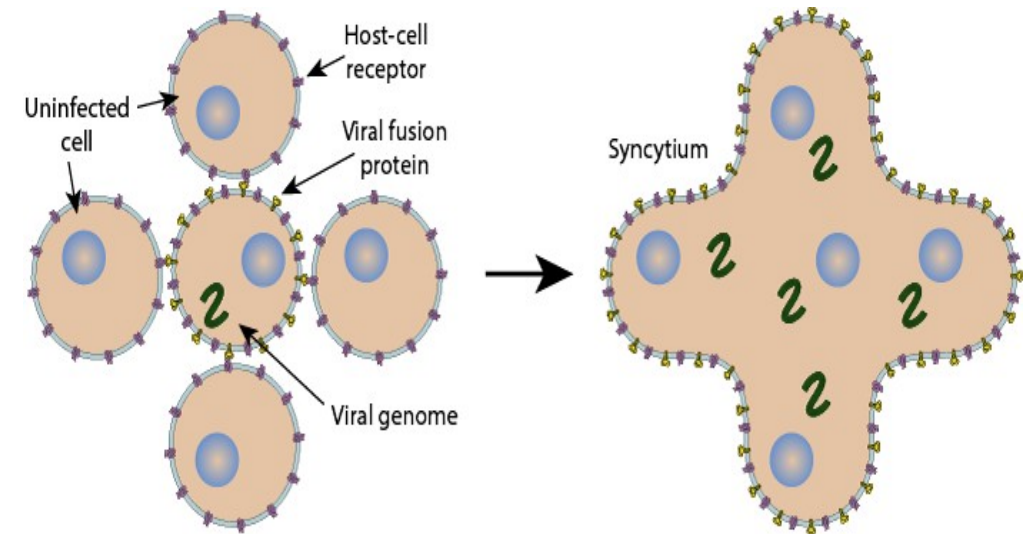
Detection of **rising titer of IgG**

Prevention

Monoclonal antibody against the RSV F (fusion) protein :

For premature infants and children with congenital heart

NB Can be used also to **treat immunocompromized patients**



Palivizumab (Synagis®): Mechanism of Action

- Palivizumab is a monoclonal antibody that binds the F (fusion) protein of RSV
- Palivizumab prevents infection of the host cell
- Palivizumab reduces viral replication and spread of RSV to other susceptible cells
- **Protective levels need to be achieved prior to exposure to RSV**



Lecture Quiz



Which virus is the leading cause of the croup syndrome in young children?

- a) Influenza virus
- b) Respiratory syncytial virus
- c) Parainfluenza virus
- d) Adenovirus
- e) Rhinovirus

SUGGESTED TEXTBOOKS



- ***Review of Medical Microbiology and Immunology,
Warren Levinson***
 - from page 683 - 697
 - from page 704 - 707
 - from page 1359 - 1360
 - from page 1363 - 1373

Thank You